

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

(e) The total peak transmitter output power shall not exceed 500 mW.

(f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

(g) Regardless of the maximum EIRP and maximum power density levels permitted under this section, devices operating under the provisions of this section are subject to the radio-frequency radiation exposure requirements specified in 47 CFR 1.1307(b), 2.1091, and 2.1093, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

[69 FR 3265, Jan. 23, 2004]

Subpart D—Unlicensed Personal Communications Service Devices

SOURCE: 58 FR 59180, Nov. 8, 1993, unless otherwise noted.

§ 15.301 Scope.

This subpart sets out the regulations for unlicensed personal communica-

tions services (PCS) devices operating in the 1920–1930 MHz band.

[69 FR 77949, Dec. 29, 2004]

§ 15.303 Definitions.

Asynchronous devices. Devices that transmit RF energy at irregular time intervals, as typified by local area network data systems.

Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Isochronous devices. Devices that transmit at a regular interval, typified by time-division voice systems.

Peak transmit power. The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used.

Personal Communications Services (PCS) Devices [Unlicensed]. Intentional radiators operating in the frequency band 1920–1930 MHz that provide a wide array of mobile and ancillary fixed communication services to individuals and businesses.

Spectrum window. An amount of spectrum equal to the intended emission bandwidth in which operation is desired.

Thermal noise power. The noise power in watts defined by the formula $N = kTB$ where N is the noise power in watts, k is Boltzmann's constant, T is the absolute temperature in degrees Kelvin (e.g., 295 °K) and B is the emission bandwidth of the device in hertz.

§ 15.305

Time window. An interval of time in which transmission is desired.

[58 FR 59180, Nov. 8, 1993, as amended at 59 FR 32852, June 24, 1994; 60 FR 13073, Mar. 10, 1995; 69 FR 62620, Oct. 27, 2004; 69 FR 77949, Dec. 29, 2004; 77 FR 43013, July 23, 2012]

§ 15.305 Equipment authorization requirement.

PCS devices operating under this subpart shall be certified by the Commission under the procedures in subpart J of part 2 of this chapter before marketing. The application for certification must contain sufficient information to demonstrate compliance with the requirements of this subpart.

§ 15.307 [Reserved]

§ 15.309 Cross reference.

(a) The provisions of subpart A of this part apply to unlicensed PCS devices, except where specific provisions are contained in subpart D.

(b) The requirements of subpart D apply only to the radio transmitter contained in the PCS device. Other aspects of the operation of a PCS device may be subject to requirements contained elsewhere in this chapter. In particular, a PCS device that includes digital circuitry not directly associated with the radio transmitter also is subject to the requirements for unintentional radiators in subpart B.

§ 15.313 Measurement procedures.

Measurements must be made in accordance with subpart A, except where specific procedures are specified in subpart D. If no guidance is provided, the measurement procedure must be in accordance with good engineering practice.

§ 15.315 Conducted limits.

An unlicensed PCS device that is designed to be connected to the public utility (AC) power line must meet the limits specified in § 15.207.

§ 15.317 Antenna requirement.

An unlicensed PCS device must meet the antenna requirement of § 15.203.

§ 15.319 General technical requirements.

(a) [Reserved]

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(b) All transmissions must use only digital modulation techniques. Both asynchronous and isochronous operations are permitted within the 1920–1930 MHz band.

(c) Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

(d) Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

(e) The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

(f) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. The provisions in this section are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

(g) Notwithstanding other technical requirements specified in this subpart, attenuation of emissions below the general emission limits in § 15.209 is not required.

(h) Where there is a transition between limits, the tighter limit shall apply at the transition point.

(i) Unlicensed PCS devices are subject to the radiofrequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a “general population/uncontrolled” environment. Applications for equipment authorization of devices operating under this section must contain a

statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

[58 FR 59180, Nov. 8, 1993, as amended at 59 FR 32852, June 24, 1994; 59 FR 40835, Aug. 10, 1994; 60 FR 13073, Mar. 10, 1995; 61 FR 41018, Aug. 7, 1996; 69 FR 62621, Oct. 27, 2004; 69 FR 77949, Dec. 29, 2004; 77 FR 43013, July 23, 2012]

§ 15.321 [Reserved]

§ 15.323 Specific requirements for devices operating in the 1920–1930 MHz band.

(a) Operation shall be contained within the 1920–1930 MHz band. The emission bandwidth shall be less than 2.5 MHz. The power level shall be as specified in §15.319(c), but in no event shall the emission bandwidth be less than 50 kHz.

(b) [Reserved]

(c) Devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(1) Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit for a period of at least 10 milliseconds for systems designed to use a 10 milliseconds or shorter frame period or at least 20 milliseconds for systems designed to use a 20 milliseconds frame period.

(2) The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth used by the device.

(3) If no signal above the threshold level is detected, transmission may commence and continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

(4) Once access to specific combined time and spectrum windows is obtained

an acknowledgment from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgments must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgment, at which time the access criteria must be repeated.

(5) If access to spectrum is not available as determined by the above, and a minimum of 20 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level may be accessed. A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 milliseconds frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value. The power measurement resolution for this comparison must be accurate to within 6 dB. No device or group of co-operating devices located within 1 meter of each other shall during any frame period occupy more than 6 MHz of aggregate bandwidth, or alternatively, more than one third of the time and spectrum windows defined by the system.

(6) If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

(7) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than $50 \times \text{SQRT}$ (1.25/ emission bandwidth in MHz) microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the applicable threshold

level, the maximum reaction time shall be $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$ microseconds but shall not be required to be less than 35 microseconds.

(8) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

(9) Devices that have a power output lower than the maximum permitted under this subpart may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

(11) An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within 1.25 MHz of the center frequency of channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

(12) The provisions of (c)(10) or (c)(11) of this section shall not be used to extend the range of spectrum occupied over space or time for the purpose of

denying fair access to spectrum to other devices.

(d) Emissions outside the band shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the band and 1.25 MHz above or below the band; 50 dB between 1.25 and 2.5 MHz above or below the band; and 60 dB at 2.5 MHz or greater above or below the band. Emissions inside the band must comply with the following emission mask: In the bands between 1B and 2B measured from the center of the emission bandwidth the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device; in the bands between 2B and 3B measured from the center of the emission bandwidth the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the band edge the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. B' is defined as the emission bandwidth of the device in hertz. Compliance with the emission limits is based on the use of measurement instrumentation employing peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(e) The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in this band shall be 20 milliseconds or 10 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per million (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm. The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two

ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

(f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within ± 10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20° to $+ 50^{\circ}$ C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20° C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

[58 FR 59180, Nov. 8, 1993; 59 FR 15269, Mar. 31, 1994. Redesignated at 59 FR 32852, June 24, 1994, as amended at 59 FR 32853, June 24, 1994; 59 FR 40835, Aug. 10, 1994; 59 FR 55373, Nov. 7, 1994; 60 FR 3303, Jan. 13, 1995; 69 FR 62621, Oct. 27, 2004; 77 FR 43013, July 23, 2012]

Subpart E—Unlicensed National Information Infrastructure Devices

§ 15.401 Scope.

This subpart sets out the regulations for unlicensed National Information Infrastructure (U-NII) devices operating in the 5.15–5.35 GHz, 5.47–5.725 GHz and 5.725–5.85 GHz bands.

[79 FR 24579, May 1, 2014]

§ 15.403 Definitions.

(a) *Access Point (AP)*. A U-NII transceiver that operates either as a bridge in a peer-to-peer connection or as a connector between the wired and wireless segments of the network.

(b) *Available Channel*. A radio channel on which a *Channel Availability Check* has not identified the presence of a radar.

(c) *Average Symbol Envelope Power*. The average symbol envelope power is the average, taken over all symbols in the signaling alphabet, of the envelope power for each symbol.

(d) *Channel Availability Check*. A check during which the U-NII device listens on a particular radio channel to identify whether there is a radar operating on that radio channel.

(e) *Channel Move Time*. The time needed by a U-NII device to cease all transmissions on the current channel upon detection of a radar signal above the DFS detection threshold.

(f) *Digital modulation*. The process by which the characteristics of a carrier wave are varied among a set of predetermined discrete values in accordance with a digital modulating function as specified in document ANSI C63.17–1998.

(g) *Dynamic Frequency Selection (DFS)* is a mechanism that dynamically detects signals from other systems and avoids co-channel operation with these systems, notably radar systems.

(h) *DFS Detection Threshold*. The required detection level defined by detecting a received signal strength (RSS) that is greater than a threshold specified, within the U-NII device channel bandwidth.

(i) *Emission bandwidth*. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(j) *In-Service Monitoring*. A mechanism to check a channel in use by the U-NII device for the presence of a radar.

(k) *Non-Occupancy Period*. The required period in which, once a channel has been recognized as containing a radar signal by a U-NII device, the channel will not be selected as an available channel.

(l) *Operating Channel*. Once a U-NII device starts to operate on an Available Channel then that channel becomes the Operating Channel.